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LISTS OF SPECIES

Checklist of benthonic marine invertebrates from Malaga Bay (Isla Palma and Los Negritos), Colombian Pacific

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ABSTRACT: The composition of marine macroinvertebrates in two localities (Isla Palma and Los Negritos) of Malaga Bay was studied. This bay is located in the Pacific coast of Colombia and was recently declared National Natural Park. The rapid ecological assessment revealed a total of 128 species belonging to 64 families and 11 classes (including threatened species). The most common groups were: Gastropoda (27%), Polychaeta (26%), Malacostraca (16%) and Pelecypoda (13%). Even though the two sites are relatively near, being apart only by 6 km, the composition of the respective communities was very different. They shared only 7.8% of the species found; which might have profound and interesting effects for conservation purposes.

INTRODUCTION

A checklist of regional marine species has many uses. Further to providing base line information and important data for comparative studies on biodiversity it also plays an important role and is an important tool in the recognition and delimitation of areas with need protecting, in the process to infer damage and impacts of anthropogenic activity, in the assessment of the complexity of biological communities, and in the estimation of resource availability (Hendrickx and Harvey 1999).

It is known that comprehensive evaluations and inventories serve as the basis for local practices of conservation, which is relevant in poorly known areas in the tropics (Hendrickx and Harvey 1999). This is the case of Malaga Bay (recently established as a National Natural Park), where the few surveys that have been carried out in the area have shown a rich diversity of intertidal and shallow subtidal marine organisms (Lazarus-Agudelo and Cantera-Kintz 2007). Furthermore, the majority of studies performed on Malaga Bay have been focused on specific taxonomic groups, like mollusks (Blanco and Cantera 1994; Cantera *et al*. 1998), echinoderms (Neira and Cantera 2005; Lozano-Cortés *et al*. 2011), fishes (Castellanos-Galindo *et al*., 2006), and crustaceans (Lazarus-Agudelo and Cantera-Kintz 2007). In order to have an integral view of the real biodiversity in the zone, the community as a whole should be considered.

Although several areas with high species richness in the world have recently received a lot of attention regarding species censuses, tropical and subtropical marine invertebrate communities are still greatly undescribed. It is important to note that most of the effort has been put on west Indopacific, Tropical Atlantic (TA) and Tropical Eastern Pacific (TEP) (Hendrickx and Harvey 1999). However, the knowledge regarding Colombian marine biodiversity, which has coast in both TA and TEP is scarce and checklists of some groups like worms, bryozoans, echinoderms and crustaceans are, at best, incomplete. Additionally, it has been suggested that the number of species recorded for these groups represent only 50% of the total richness expected for Colombia (Díaz and Acero 2003).

Considering the incomplete knowledge of the animal biodiversity associated to the intertidal and shallow subtidal marine ecosystems, the aim of this survey was to produce a preliminary checklist of marine macroinvertebrates inhabiting two localities of Malaga Bay (Isla Palma and Los Negritos). Mollusks and crustaceans were sampled as well although they are the most common animals in the intertidal and shallow subtidal habitats. Special attention was put on poorly known taxonomic groups in order to improve the base line knowledge on the biodiversity in the region and to provide useful information to policy makers in order to facilitate decisions regarding the protection and conservation of Malaga Bay.

MATERIALS AND METHODS

Study area

Malaga Bay is located in the middle of the Colombian coast on the Tropical Eastern Pacific (3.93 – 4°08' N; 77.32 – 77°35' W; Figure 1). This area experiences a broad tidal range (*ca*. 4 m) and the weather characteristics are determined by the occurrence of the intertropical convergence zone and the Equatorial low pressure area (Cantera *et al*. 1998; Amaya 2007).

The two sampling localities Isla Palma and Los Negritos, are located at the outer part of the Bay. Isla Palma (3°53' N - 77°21' W; Figure 1) is a small island (*ca*. 138 ha) located less than 4 km off the coast and is surrounded by rocky cliffs with heights between 6 m and 15 m. Los Negritos (3°53' N - 77°24' W; Figure 1) is an intertidal rocky reef located southwest (*ca*. 6 km away) from the coast of Isla Palma and is formed by volcanic rocks in contrast to other rocky areas of Malaga Bay (*e.g*. Isla Palma itself) which are

formed mainly by sedimentary rocks (Lozano-Cortés *et al*. 2011).

Data collection and identification

At each site, samples were collected by intensive scrutiny of animals hidden in cracks and under stones, both in the subtidal and shallow subtidal, where the sampling was performed using SCUBA and snorkeling. At Isla Palma, the submerged walls of the cliffs were also sampled and some boulders were extracted to look for infauna (*e.g*. polychaets, mytilid bivalves and alpheid shrimps). At Los Negritos rocky reef, samplings were also conducted during low tide, when the rocks were exposed (intertidal sampling). The maximum depth, at which samplings were performed, was 6 m for Isla Palma and 12 m for Los Negritos.

The samples were kept in seawater until sorting by taxonomic groups was performed. The animals were anesthetized by gradually adding fresh water and magnesium chloride to the seawater. After that, samples were fixed in 10% formalin or 70% alcohol, depending on the group. Photographs of most live or recently fixed animals were taken in order to have a record of natural coloration, since most animals (e.g. nudibranches) lose it when they become in contact with fixatives. Once fixed, samples were transported to the Universidad del Valle marine laboratory for identification and storage. Organisms were identified to the lowest possible taxonomic level following Prahl *et al*. (1986), Breedy and Guzmán (2003, 2007) for octocorals, Keen (1972) for mollusks, Poupin and Bouchard (2006), Hendrickx (1995), Martin and Davis (2001) and Ng *et al.* (2008) for crabs, Brusca (1980), Cantera (2011) and FAO guide (Fischer *et al*. 1995) for other invertebrates. Finally, all species were preserved in 70% alcohol and stored in the Reference Collection of Marine Biology – Universidad del Valle (CRBMUV for its name in Spanish).

Results and Discussion

A total of 128 species of marine invertebrates belonging to 64 families were collected (Table 1). The faunal composition was distributed in 10 groups, with 64.1% found in Isla Palma and 40.6% in Los Negritos. Only 7.8% (10 species) was shared between the two places. Within the species found, the presence of 3 species considered threatened on Malaga Bay were relevant (2 cnidarians; *Leptogorgia alba*, *Pacifigorgia symbiotica* and 1 mollusc; *Pinctada mazatlanica*, Castellanos-Galindo *et al.* 2011). Gastropods and Polychaetes were the groups with the highest richness (34 and 33 species, Figure 2); the latter group was composed of species belonging mostly to endofauna and hence was only collected at Isla Palma (Figure 3), a result that is related to the type of substrate in the locality.

In the class Pelecypoda (16 species), the family Mytilidae was the most representative with 5 species, all of which were collected at Isla Palma. The higher species number in this site is explained in terms of their substrate composition: a considerable number of boulders and some of these rocks, which serve as a habitat for infauna, were removed and sampled. The comparison of the study to previous ones (Guevara-Fletcher 2006, Invemar *et al*. 2006, Guevara-Fletcher *et al*. 2011) reveals that there are seven species as new records for Isla Palma (*Barbatia reeveana, Trigoniocardia biangulata, Papyridea aspersa, Lithophaga plumula, L. attenuata, L. spatiosa,* and *Gregariella coarctata*)

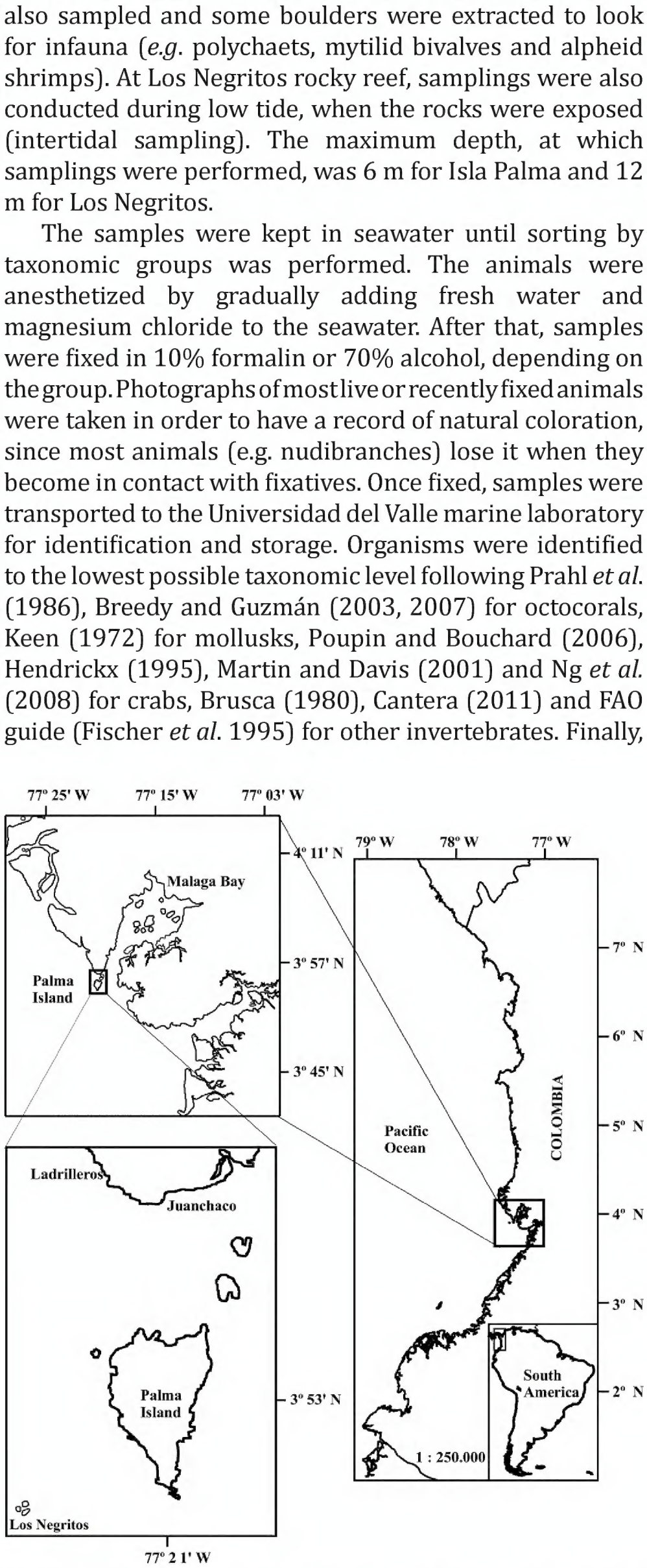

Figure 1. Study sites (Isla Palma – IP and Los Negritos – LN) in Malaga Bay, Colombian Pacific Ocean (Modified from Castellanos-Galindo and Giraldo 2008).

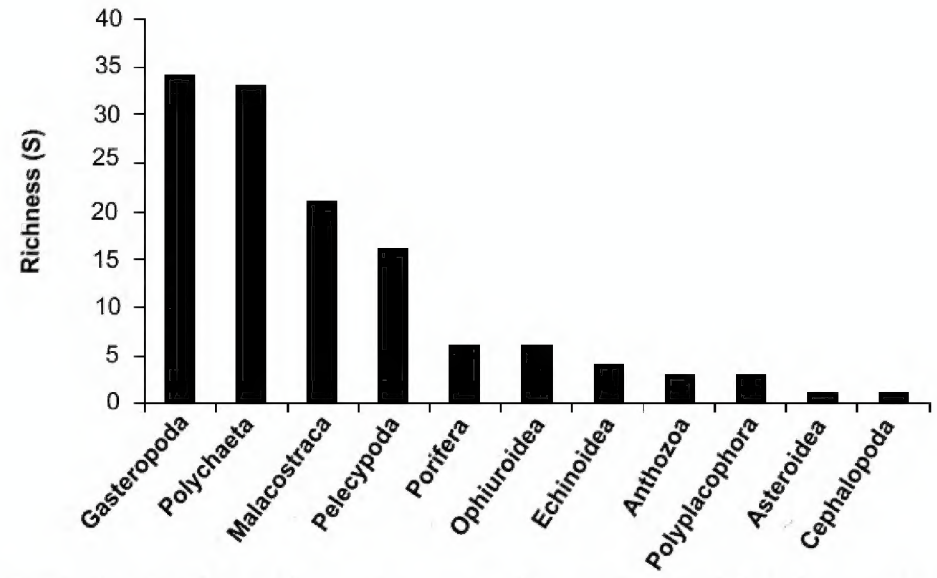

Figure 2. Total number of species by group for benthic marine invertebrates collected in two localities of Malaga Bay.

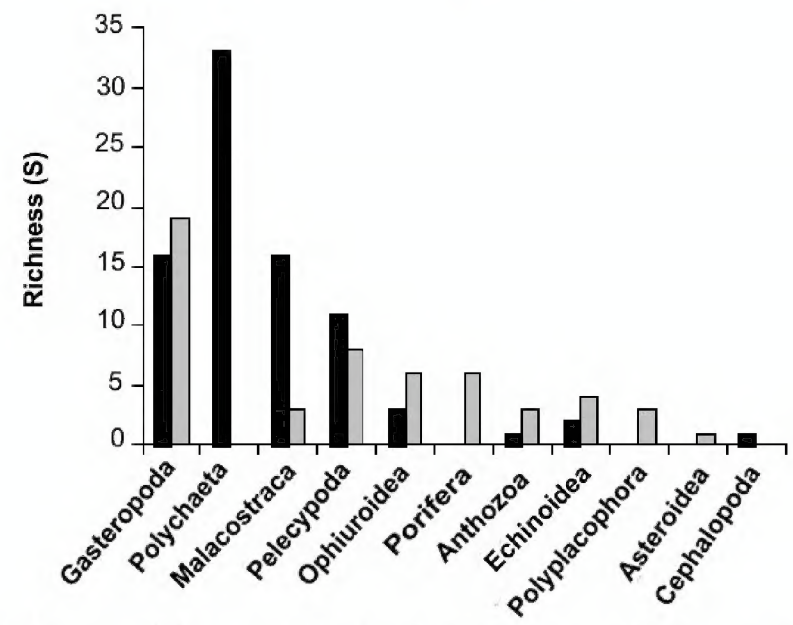

Figure 3. Species richness of principal marine invertebrates groups on Isla Palma (black bars) and Los Negritos (gray bars).

and six for Los Negritos (*B. reeveana, T. biangulata, Cardita affinis, Periglypta multicostata, Gastrochaena ovata* and *Pholadidea tubifera*).

Malacostraca was the third group in number of species with a total of 21, belonging to eight families. The site with the highest diversity was Isla Palma with 76.2 % of the species collected from this class (Figure 3); this diversity could be associated with a higher number of microhabitats that can be seen in this area due to the sedimentary origin of the rocks. However, the number of species collected can be strongly influenced by sampling effort. Almost all of the species reported in this work, have been already reported by other authors working in the bay (Invemar *et al*. 2006, Lazarus-Agudelo and Cantera-Kintz 2007, Guevara-Fletcher *et al*. 2011). Nevertheless, there is a new report for Isla Palma (*Neogonodactylus stanschi*, Table 1) expanding its range within the bay.

Echinoderms which are recognized to be a key component in the benthic communities (Hendler *et al*. 1995) were represented with 11 species divided into 3 classes and 8 families. The most representative class was Ophiuroidea with 6 species. This result contrasts with some areas where this class had the lowest richness (*e.g*. Malpelo Island; Cohen-Rengifo *et al*. 2009). Nevertheless, this could be explained because this class is the most diverse group of living echinoderms (Giese *et al*. 1991) and numerically are the most abundant group in the Colombian Pacific (Neira and Cantera 2005). All the species reported in this work were found in Los Negritos; only 5 of them were found in Isla Palma, possibly because this is a rocky reef where echinoderms have a great ecological significance (Lawrence 1987). Finally, even though the two sample sites are relatively close, the macroinvertebrate composition was quite different, suggesting a habitat differentiation process related to habitat composition and heterogeneity. In this order, this kind of inventories not only helps to improve our knowledge about those species inhabiting these areas but also provides tools for taking decisions to protect those ecosystems that are in need of conservation.

Table 1. Checklist of benthic marine invertebrates registered for two localities of Malaga Bay (Isla Palma and Los Negritos). Species marked with an asterisk indicate new reports for the bay (*).

PHYLUM	CLASS	ORDER	FAMILY	SPECIES	LOCALITY	
					Isla Palma	Los Negritos
PORIFERA	Demospongiae	Halichondriida	Hymeniacidonidae	*Hymeniacidon* sp. (Bowerbank, 1858)		X
		Haplosclerida	Haliclonidae	*Haliclona* sp. (Grant, 1836)		X
		Leucosdeniida	Grantiidae	*Leucandra* sp. (Haeckel, 1872)		X
		Verongiida	Aplysinidae	-		X
		Hadromerida	Suberitidae	*Suberites* sp. (Nardo, 1833)		X
		Axinellida	Axinellidae	-		X
CNIDARIA	Anthozoa	Alcyonacea	Gorgoniidae	*Pacifigorgia symbiotica* (Williams and Breedy, 2004)		X
				Pacifigorgia sp. (Bayer, 1951)		X
				Leptogorgia alba (Duchassaing and Michelotti, 1864)	X	
MOLLUSCA	Polyplacophora	Neoloricata	Ischnochitonidae	*Radsiella dispar* (Sowerby, 1832)		X
				*Stenoplax limaciformis** (Sowerby, 1832)		X
			Acanthochitonidae	*Acanthochitona hirudiniformis* (Sowerby, 1832)		X
	Gastropoda	Neogastropoda	Columbellidae	*Columbella strombiformis* (Lamarck, 1822)	X	
				Mitrella elegans (Dall, 1871)	X	
			Buccinidae	*Cantharus gemmatus* (Reeve, 1846)	X	X
				Cantharus ringens (Reeve, 1846)	X	
			Fasciolariidae	*Pustulatirus mediamericanus* (Hertlein and Strong, 1951)		X
				Leucozonia cerata (Wood, 1828)	X	
			Muricidae	*Murexiella vittata* (Broderip, 1836)	X	
				Nucella melones (Duclos, 1832)		X
				Muricopsis zeteki (Hertlein and Strong, 1951)		X
				Thais speciosa (Valenciennes, 1832)		X
				Acanthais brevidentata (Wood, 1828)		X
			Turbinidae	*Turbo saxosus* (Wood, 1828)		X
			Triviidae	*Trivia pacifica* (Sowerby, 1832)	X	
			Cerithiidae	*Cerithium uncinatum* (Gmelin, 1791)		X
				Cerithium nicaragüense (Pilsbry and Lowe, 1932)		
			Mitridae	*Mitra tristis* (Broderip, 1836)		X
			Lottiidae	*Lottia* sp. (Gray, 1833)	X	
				Lottia pediculus (Philippi, 1846)		X
			Neritidae	*Nerita scabricosta* (Lamarck, 1822)		X
			Cypraeidae	*Cypraea robertsi* (Hidalgo, 1960)		X
			Olivellidae	*Oliva splendidula* (Sowerby, 1825)	X	

TABLE 1. ***CONTINUED.***

PHYLUM	CLASS	ORDER	FAMILY	SPECIES	LOCALITY	
					Isla Palma	Los Negritos
MOLLUSCA	GASTROPODA	Neogastropoda	Olivellidae	*Olivella rehderi* (Olsson, 1956)		X
			Bursidae	*Bursa corrugata corrugata* (Perry, 1811)		X
				Bursa sp. (Röding, 1798)		X
			Calyptraeidae	*Crepidula* sp. (Lamarck, 1799)	X	
			Turbinidae	*Tegula* sp. (Lesson, 1832)	X	
			Strombidae	*Strombus gracilior* (Sowerby, 1825)	X	
		Sacoglossa	Elysiidae	*Elysia diomedea* (Bergh, 1894)	X	
		Nudibranchia	Chromodorididae	*Chromodoris sedna** (Marcus and Marcus, 1967)		X
				*Hypselodoris californiensis** (Bergh, 1879)	X	
				Hypselodoris sp. (Stimpson, 1855)	X	
		Pleurobranchomorpha	Pleurobranchidae	*Berthellina ilisima* (Marcus and Marcus, 1967)		X
		Anaspidea	Aplysiidae	*Dolabrifera dolabrifera* (Rang, 1828)		X
		Systellommatophora	Onchidiidae	*Onchidella hildae* (Hoffmann, 1928)		X
	PELECYPODA	Arcoida	Arcidae	*Barbatia reeveana* (d'Orbigny, 1846)	X	
				Barbatia gradata (Broderip and Sowerby, 1829)	X	X
		Carditoida	Carditidae	*Cardita affinis* (Sowerby, 1833)		X
		Euheterodonta	Gastrochaenidae	*Gastrochaena ovata* (Sowerby, 1834)	X	
		Myoida	Pholadidae	*Pholadidea tubifera* (Sowerby, 1834)	X	
		Mytiloida	Mytilidae	*Lithophaga plumula* (Hanley, 1844)	X	X
				Lithophaga attenuata (Deshayes, 1836)	X	
				Lithophaga aristata (Dillwyns, 1817)	X	
				Lithophaga spatiosa (Carpenter, 1857)	X	
				Gregariella coarctata (Carpenter, 1857)	X	
		Pterioida	Pteriidae	*Pinctada mazatlanica* (Hanley, 1856)	X	
		Veneroida	Cardiidae	*Trigoniocardia biangulata* (Broderip and Sowerby, 1829)		X
				Trachycardium senticosum (Sowerby, 1833)	X	
			Chamidae	*Papyridea aspersa* (Sowerby, 1833)	X	X
			Veneridae	*Tivela byronensis* (Gray, 1838)		X
				Periglypta multicostata (Sowerby, 1835)		X
	CEPHALOPODA	Octopoda	Octopodidae	-		X
ECHINODERMATA	ASTEROIDEA	Valvatida	Ophidiasteridae	*Pharia pyramidata* (Gray, 1840)	X	
	OPHIUROIDEA	Ophiurida	Ophiolepididae	*Ophiolepis plateia* (Ziesenhenne, 1940)		X
			Ophiocomidae	*Ophiocoma aethiops* (Lütken, 1859)	X	X
				Ophiocoma alexandri (Lyman, 1860)		X
			Ophiodermatidae	*Ophioderma panamensis* (Lütken, 1859)		X
				Ophioderma teres (Lyman, 1860)	X	X
			Ophiotrichidae	*Ophiotrhix spiculata* (Le Conte, 1851)		X
	ECHINOIDEA	Cidaroida	Cidaridae	*Hesperocidaris asteriscus* (Clark, 1948)	X	X
		Diadematoida	Diadematidae	*Centrostephanus coronatus* (Verril, 1867)	X	X
				Diadema mexicanum (Agassiz, 1863)		X
		Camarodonta	Echinometridae	*Echinometra vanbrunti* (Agassiz, 1863)		X
ANNELIDA	POLYCHAETA	Eunicida	Eunicidae	*Eunice aphroditois* (Pallas, 1788)	X	X
				Eunice sp. 1 (Cuvier, 1817)	X	
				Eunice sp. 2	X	
				Eunice sp. 3	X	
				Eunice sp. 4	X	
				Eunice sp. 5	X	
				Eunice sp. 6	X	
				Eunice sp. 7	X	
				Eunice sp. 8	X	
				Eunice sp. 9	X	
		Canalipalpata	Serpulidae	*Serpula* sp. (Linnaeus, 1758)	X	
		Amphinomida	Amphinomidae	*Amphinomidae* sp. 1 (Savigny, 1818)	X	
				Amphinomidae sp. 2	X	
		Phyllodocida	Syllidae	*Syllidae* sp. 1 (Grube, 1850)	X	
				Syllidae sp. 2	X	
				Syllidae sp. 3	X	
				Syllidae sp. 4	X	

Table 1. ***Continued.***

PHYLUM	CLASS	ORDER	FAMILY	SPECIES	LOCALITY	
					Isla Palma	Los Negritos
ANNELIDA	Polychaeta	Phyllodocida	Nereidae	*Platynereis* sp. (Kinberg, 1865)	X	
				Nereidae sp. 1 (Fauchald, 1977)	X	
				Nereidae sp. 2	X	
				Nereidae sp. 3	X	
				Nereidae sp. 4	X	
			Phyllodocidae	*Eulalia* sp. 1 (Savigny, 1818)	X	
				Eulalia sp. 2	X	
				Eulalia sp. 3	X	
				Eulalia sp. 4	X	
			Polynoidae	*Polynoidae* sp. 1 (Malmgren, 1867)	X	
				Polynoidae sp. 2	X	
				Polynoidae sp. 3	X	
				Polynoidae sp. 4	X	
				Polynoidae sp. 5	X	
				Polynoidae sp. 6	X	
			Pilargidae	*Pilargidae* sp. (de Saint-Joseph, 1899)	X	
		Decapoda	Alpheidae	*Alpheus panamensis* (Kingsley, 1878)	X	
				Alpheus sp. (Fabricius, 1798)	X	
			Upogebiidae	*Upogebia* sp. (Leach, 1814)	X	
			Gonodactylidae	*Neogonodactylus stanschi* (Schmitt, 1940)	X	
			Diogenidae	*Calcinus obscurus* (Stimpson, 1859)	X	
				Trizopagurus magnificus (Bouvier, 1898)		X
			Porcellanidae	*Pachycheles calculosus* (Haig, 1960)		X
				Pachycheles chacei (Haig, 1956)	X	
				Pachycheles panamensis (Faxon, 1893)	X	
				Pachycheles vicarius (Nobili, 1901)	X	
				Megalobrachium pacificum (Gore and Abele, 1974)	X	
				Megalobrachium garthi (Haig, 1957)	X	
				Pisidia magdalenensis (Glassell, 1936)	X	
				Petrolisthes donadio (Hiller and Werding 2007)	X	
			Majidae	*Mithrax tuberculatus* (Stimpson, 1860)	X	
				Mithraculus denticulatus (Bell, 1835)	X	
			Xanthidae	*Cycloxanthops vittatus* (Stimpson, 1860)	X	
				Heteractaea lunata (Milne-Edwards and Lucas, 1844)	X	X
				Platyactaea dovii (Stimpson, 1871)		
				Paractaea sulcata (Stimpson, 1860)		
			Epialtidae	*Herbstia tumida* (Stimpson, 1871)		
		Stomatopoda	Gonodactylidae	*Neogonodactylus stanschi* (Schmitt, 1940)	X	
TOTAL			64	128	82	52

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